

Seed Testing

Definition

- Seed testing may be defined as the procedure by which the suitability of a seed to use as a planting material is evaluated.
- Seed testing is the science of evaluating seed quality for agricultural purposes.

Objectives

1. To determine the planting value of seeds.
2. To determine the legal requirement of seed as planting materials.
3. To determine the real seed rate.
4. To determine the seed weather that it is alive, dormant or dead.
5. To determine the viability and vigour of seed.
6. To certify seed.
7. To export the seed as planting material.
8. To ensure the production and supply of good quality seed.

Sample: It is a part of population that represent the population.

Seed sample: Small part or amount of seed which is collected from seed lot for testing is called seed sample.

Seed sampling: The process of collection of sample is called seed sampling.

Types of seed sample

1. **Primary sample:** The sample which is taken from different bulk seedlot is called primary sample.
2. **Composite sample:** When the primary sample mixed is called composite sample which is sent to the laboratory for analysis.
3. **Submitted sample:** When the samples submitted to laboratory for analysis is called submitted sample.
4. **Working sample:** When the sample reaches the laboratory must be divided into a size and content that can be analysed. The later sample is used for the actual analysis/test is called working sample.

Seed Viability

- Seed viability means that a seed capable of germinating and producing normal seedling.
- A viable seed is one which is capable of germination under suitable conditions. The definition includes dormant but viable seeds, in which case the dormancy must be broken before viability can be measured by germination.

Factors affecting seed viability

- Genetic constituent of seed.
- Environmental conditions during seed formation, development and maturation.
- Age of seed.
- Storage condition of seed.
- Food reserve.
- Location of seed on inflorescence.

Tests used for determining the viability of seeds

1. Standard germination test.
2. Tetrazolium test (biochemical test).
3. Embryo excision method.
4. Respiration test.
5. Electrical conductance method.
6. Potassium permanganate method.
7. Plasmolysis method.
8. X-ray test.
9. Free fatty acids test etc.

Tetrazolium Test (TZ Test)

The Tetrazolium Test provides a quick estimate of seed viability. With results within one to two hours/days this test can be very helpful when time is a factor or for species which have very long germination requirements.

Tetrazolium testing originated in Germany during the early 1940's. George Lakon and colleagues discovered that embryonic tissues had to be alive and respiring in order for the seed to germinate normally. Their early biochemical work led to the development of a 'topographical' staining method for determining seed viability. The early experiments used toxic chemicals such as selenium and tellurium to indicate viability, which limited their usefulness in seed testing. In 1942, Lakon developed a method using less-toxic tetrazolium as the viability indicator.

Principles of Tetrazolium test

The tetrazolium test distinguishes between viable and dead tissues of the embryo on the basis of their relative respiration in the hydrated state. Although many enzymes are active during respiration, the test utilizes the activity of *dehydrogenase* enzymes as an index to the respiration rate and seed viability. *Dehydrogenase* enzyme react with substrates and release hydrogen ions to the oxidised, colourless, tetrazolium salt solution, which is changed into red *Formazan* as it is reduced by hydrogen ion. This *Formazan* is an insoluble purple or red compound indicating the presence of life.

Apparatus required

- Seed samples.
- Magnifying glass.
- Solution of tetrazolium (0.1–0.5 %).
- Petridishes.
- Dropper and bottle.
- Scissors/knife.

Procedure

1. The seeds are soaked in water for overnight to allow absorption of soften the embryo and endosperm and active the enzyme system.
2. Seed coats were then removed to expose the embryo and to facilitate the contact of embryo with a tetrazolium solution.
3. The seeds were then put in tetrazolium salt solution for 2 hours.
4. The seeds were then washed repeatedly with distilled water.
5. Ultimately the seeds were examined under magnifying glass.

Observation

- **Living seed:** Red colour or purple colour of the embryo indicates the living seed.
- **Dead seed:** No colour will be occurred in embryo which indicates the dead seed. If the embryo of seed is not stained but red colour develops on the other parts then it will be treated as dead seed.

Advantage

1. Reliable indications of viability can be obtained in 24 to 28 hours.
2. Ability to anticipate weakness before they are evident in germination.
3. Useful if other equipment is unavailable.
4. Doubt at the completion of a germination test because of unbroken dormancy.
5. For an experienced analyst each deviation in embryo staining one or more cause of damage i.e. mechanical damage, heating etc.

Disadvantage

1. It requires a great deal of skill and experiences to complete this test accurately.
2. It does not show up dormancy problems unless done in conjunction with a germination test.
3. Fungicide or insecticide treated seed may not shown phytotoxic effects as in germination test.
4. Although an answer on viability is more quick attainable, the actual time taken to do a TZ test much longer than that of the standard germination.

Seed Vigour

- ▶ Seed vigour is the measures of the physiological stamina and healthyness of seeds.
- ▶ Seed vigour may be defined as those seed properties which determine the potential for rapid uniform emergence and development of normal seedlings under a wide range of field conditions.
- ▶ The organic power of the seed is called seed vigour. On the other hand, the intensity of living force is called vigour of seed.

Factors affecting seed vigour

- Genetic makeup.
- Seed maturity.
- Temperature and moisture availability.
- Soil fertility.
- Seed size.
- Mechanical damage.

- Seed age and deterioration.
- Attack of microorganism.

Difference between seed viability and seed vigour

Seed viability	Seed vigour
Seed viability is the capability of germination of seed and producing normal seedling.	Seed vigour is the speed of germination.
It is the highest time for physiological maturity.	It is not concern.
After physiological maturity the seed viability will be declined.	It varies seed to seed.
The result are exposed in terms of percentage by count.	The result not expressed by count.
For this test one, one variety is required.	At least two species is required for this test.
The viability test is done to ascertain the proportion of living or dead seed present in a seed sample.	Seed vigour test differentiate high vigour seed from low vigour seed.

Significance of seed vigour in crop production

Seed vigour is an important factor in crop production. The significance of seeds vigour is given below:

1. Seed germination depends on seed vigour.
2. Seed vigour determines the potential level and activity of a non dormant seed.
3. Crop production depends on seed vigour. If the seed contain more organic power, the seed will produce healthy plant. On the other hand, if the seed has lack of organic power, the seed will produce a weak plant.
4. Plant growth depends on seed vigour. Plant from a vigorous seed grows rapidly.
5. Uniform emergence depends on seed vigour.
6. Development of normal Seedling under a wide range of field conditions.
7. To evaluate the capacity of seeds to face adverse condition.
8. Seed size and weight extremely important characteristics associated with Seedling vigour.

Characteristics of normal and abnormal seedling

► Normal seedling

► High vigour normal seedling

- A well developed root and shoot system including primary tap root.
- Well developed intact epicotyls and hypocotyls without any damage to the conducting tissue.
- Presence of healthy cotyledons.
- Presence of primary and secondary root.
- Presence of healthy primary leaves.
- Presence of healthy growing point.

► Low vigour normal seedling

- Slightly smaller cotyledons and primary leaves.
- Slightly narrow and weak stem having all other parts.
- Roots of poor growth.

► Abnormal Seedling

- Seedling with no or damaged cotyledon.
- Seedling with constriction.
- Seedling with splits, cracks or lesions.
- Seedling with damaged primary leaves and apical bud.
- Seedling with weak and unbalanced development of the essential structures.
- Injurious hypocotyls and epicotyls.
- Very poor root system.